RP 832 Lightning Protection System Condition Based Monitoring

The following recommended practice (RP) is subject to the disclaimer at the front of this manual. It is important that users read the disclaimer before considering adoption of any portion of this recommended practice.

This recommended practice was prepared by a committee of the AWEA Operations and Maintenance (O&M) Committee.

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Purpose and Scope

The scope of “Lightning Protection System Condition Based Monitoring” provides suggested methods for condition based monitoring (CBM) of the lightning protection system. Specific methods of monitoring are not provided but the requirements for monitoring are described.

Introduction

The main purpose of the lightning protection system is to provide sufficient protection for the wind turbine to avoid damages in the event of a lightning strike. The lightning protection system can prevent or reduce damage that results in forced production outages and long-term degradation of components.

Lightning Protection System Condition Based Monitoring

1. Monitoring Direct Attachment

1.1. Online Triggering CBM

As a minimum, it is recommended to monitor lightning strikes to the wind turbine by a simple trigger circuit that provides a digital signal in the event of a lightning strike. The trigger signal should be monitored by the controller of the wind turbine, and this triggering may be correlated with other CBM signals/data so eventually incidents can be compared to the occurrence of a lightning strike.

1.2. Parameter Measuring CBM

The online triggering CBM can be extended to also measure the typical relevant parameters of the lightning. By measuring such parameters, the chance of success in predicting and evaluating damage is further enhanced. These parameters are stored as values in the wind turbine data log and can be correlated with other events, trends, or developments that might originate from the specific time of triggering.

1.2.1. Peak Current

This parameter is the easiest to measure. It will tell if there is risk of damage for connection components or risk of magnetic field coupling, i.e. damage to other parallel electrical components.

1.2.2. Energy

This parameter provides information about overheating risk of conduction materials.

1.2.3. Charge

The charge will indicate the wear erosion on lightning attachment points and rotational transfer systems/bearings.

1.2.4. Current Rate-of-Change

The steepness of di/dt in a lightning strike will indicate whether there is a risk of coupled transients or failing insulation.

1.3. Wave Shape Logging CBM

As a supplement to the online triggering and parameter logging, the CBM can be extended to log the actual wave shapes of the lightning. The system logs and stores the curves. The curves can be used for further analysis of the lightning attachment.

1.4. Location Logging CBM

Each of the suggested systems can be expanded to either measure at several points or to do one detailed measurement. This will provide knowledge of where the lightning has attached and specific areas can be targeted for subsequent investigation or monitoring.

2. Monitoring Indirect Effects

2.1. Surge Protective Devices (SPD) Failure Monitoring

If the SPD system provides feedback, this feedback should be monitored. Furthermore, several systems use an upstream fuse that also needs to be monitored, if present. This monitoring may be done online, and any fault will require a service visit to the wind turbine to replace the defective component.

2.2. CBM of Surge Protective Devices

It is suggested that the operation of SPDs be monitored. By continuous monitoring and counting of transients, the SPD can be predictably maintained.

3. Inspecting the Lightning Protection System

On an annual basis, it is recommended that a full inspection is performed on all wear parts of the lightning protection system. The system should be inspected for excessive wear or defects. All adjustable systems should be inspected for correct adjustment and corrected if needed.

Reference

[1] *Wind Turbines - Part 24: Lightning Protection*, IEC 61400-24:2010, 2010.

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Chapter 9 Quality Assurance

Operations and Maintenance
Recommended Practices

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